

I CLAIM:

1. A dispensing apparatus for dispensing fluids to a patient comprising:

(a) an outer housing;

(b) a first expandable housing disposed within said outer housing, said first expandable housing having a fluid reservoir provided with an inlet for permitting fluid flow into said fluid reservoir and an outlet for permitting fluid flow from said fluid reservoir;

(c) stored energy means disposed within said outer housing for exerting a force upon said first expandable housing to cause the fluid contained within said fluid reservoir to controllably flow through said outlet, said stored energy means comprising a compressively deformable, elastomeric member carried within said outer housing said, elastomeric member being expandable to cause fluid flow from said fluid reservoir;

(d) fill means carried by said outer housing for filling said reservoir with the fluid to be dispensed;

(e) modulating means carried by said outer housing for modulating the force exerted upon said first expandable housing by said stored energy means, said modulating means comprising a second expandable housing carried by said outer housing and operably associated with said first expandable housing; and

(f) dispensing means carried by said outer housing for dispensing fluid to the patient.

2. The apparatus as defined in claim 1 in which said elastomeric member comprises a yieldably deformable spring.

3. The apparatus as defined in claim 1 in which said first expandable housing comprises a bellows structure having an accordion-like side wall and, said bellows structure being movable from a substantially collapsed configuration to a substantially expanded configuration by fluid flowing into said fluid reservoir.

4. The apparatus as defined in claim 1 further including flow control means connected to said outer housing for controlling fluid flow between said reservoir and said dispensing means, said flow control means comprising a flow control member in fluid communication with said reservoir, said flow control member having a plurality of elongated flow control channels.

5. The apparatus as defined in claim 1 in which said fill means comprises a first fill vial receivable within said third portion of said outer housing.

6. The apparatus as defined in claim 1 in which said second expandable housing comprises a bellows structure having an accordion like side wall defining a fluid chamber for containing a fluid, said second expandable housing having a fluid outlet and being movable from a substantially expanded configuration to a substantially collapsed configuration by force exerted thereon by said stored en-

ergy means.

7. The apparatus as defined in claim 6 in which said modulating means further includes impedance means disposed within said fluid outlet of said second expandable housing for controllably impeding the flow of the fluid contained within said fluid chamber outwardly thereof.

8. The apparatus as defined in claim 7 in which said impedance means comprises a porous frit.

9. The apparatus as defined in claim 8 in which said fluid contained within said bellows structure comprises a gas.

10. A dispensing apparatus for dispensing fluids to a patient comprising:

- (a) an outer housing having first, second and third portions;
- (b) a first expandable housing disposed within said outer housing, said first expandable housing having a fluid reservoir provided with an inlet for permitting fluid flow into said fluid reservoir and an outlet for permitting fluid flow from said fluid reservoir, said first expandable housing comprising a bellows structure having an accordion-like side wall movable from a substantially collapsed configuration to a substantially expanded configuration by fluid flowing into said fluid reservoir;
- (c) stored energy means disposed within said second portion of said outer housing for exerting a force upon said inner expandable housing

to cause the fluid contained within said fluid reservoir to controllably flow through said outlet, said stored energy means comprising a compressively deformable, spring member carried within said outer housing, said spring member being expandable to cause fluid flow from said fluid reservoir;

(d) fill means carried by said outer housing for filling said reservoir with the fluid to be dispensed;

(e) modulating means carried by said outer housing for modulating the force exerted upon said inner expandable housing by said stored energy means, said modulating means comprising a second expandable housing carried by said outer housing and operably associated with said first expandable housing, said second expandable housing comprising a bellows structure having an accordion-like side wall defining an air chamber for containing air, said second expandable housing having an outlet for permitting the flow of air there through and being movable from a substantially expanded configuration to a substantially collapsed configuration by force exerted thereon by said spring member;

(f) dispensing means carried by said outer housing for dispensing fluid to the patient; and

(g) flow control means connected to said outer housing for controlling fluid flow between said reservoir and said dispensing means.

11. The apparatus as defined in claim 10 in which said fill means comprises a first fill vial receivable within said third portion of said outer housing and in which said third portion of said outer housing includes:

- (a) a fluid passageway;
- (b) a first chamber for telescopically receiving said first fill vial;

and

- (c) an elongated support mounted within said first chamber, said elongated support having an elongated hollow needle, said hollow needle defining a flow passageway in communication with said fluid passageway.

12. The apparatus as defined in claim 10 in which said third portion of said outer housing includes a cavity in communication with said inlet of said fluid reservoir and in which said fill means comprises a pierceable septum disposed within said cavity.

13. The apparatus as defined in claim 10 in which said modulating means further includes impedance means disposed within said outlet of said second expandable housing for controllably impeding the flow of the air contained within said air chamber outwardly thereof.

14. The apparatus as defined in claim 10 in which said flow control means comprises a flow control assembly including:

- (a) an inlet manifold having an inlet port in communication of with

said outlet of said first expandable housing; and

(b) an outlet manifold connected to said inlet manifold, said outlet manifold having an elongated micro channel in communication with said inlet port of said inlet manifold and in communication with said dispensing means.

15. The apparatus as defined in claim 10 in which said flow control means comprises a flow control assembly including:

(i) an ullage-defining member having a first portion disposed within said first expandable housing and a second portion having a fluid passageway in communication with said outlet of said fluid reservoir;

(ii) a flow control member rotatably mounted within said first portion of said ullage defining member, said flow control member having a plurality of elongated flow control channels, each of said plurality of elongated flow control channels having an inlet and an outlet; and

(iii) selector means rotatably connected to said second portion of said ullage defining member for rotating said flow control member to selectively align an outlet of one of said elongated flow control channels with said fluid passageway in said second portion of said ul-

lage defining member.

16. The apparatus as defined in claim 15 in which said flow control assembly further comprises:

- (a) an outer casing circumscribing said flow control member; and
- (b) distribution means formed in said flow control member for distributing fluid from said fluid reservoir to each of said plurality of elongated flow control channels.

17. The apparatus as defined in claim 16, in which said flow control member is provided with an inlet passageway in communication with said fluid reservoir and in which said flow control assembly further includes filter means carried by said flow control member for filtering fluid flowing toward said distribution means.

18. The apparatus as defined in claim 17 in which said distribution means comprises a plurality of radially extending flow passageways formed in said flow control member.

19. The apparatus as defined in claim 18 in which said selector means comprises a selector knob connected to said flow control member, said selector knob having finger gripping means for imparting rotation to said selector knob to align said outlet of a selected one of said elongated flow control channels with said outlet of said fluid passageway in said second portion of said ullage defining mem-

ber.

20. The apparatus as defined in claim 19, further including volume indicator means for indicating the volume of fluid remaining in said fluid reservoir.

21. The apparatus as defined in claim 20 further including disabling means for preventing fluid flow toward said dispensing means.

22. A dispensing apparatus for dispensing fluids to a patient comprising:

(a) an outer housing;

(b) a first expandable housing disposed within said outer housing, said first expandable housing having a fluid reservoir provided with an inlet for permitting fluid flow into said fluid reservoir and an outlet for permitting fluid flow from said fluid reservoir, said first expandable housing comprising a bellows structure having an accordion-like side wall movable from a substantially collapsed configuration to a substantially expanded configuration by fluid flowing into said fluid reservoir;

(c) stored energy means disposed within said outer housing for exerting a force upon said first expandable housing to cause the fluid contained within said fluid reservoir to controllably flow through said outlet, said stored energy means comprising a compressively deformable, wave spring carried within said outer housing, said wave spring being expandable to cause fluid flow from said fluid reservoir;

(d) fill means carried by said outer housing for filling said reservoir with the fluid to be dispensed;

(e) modulating means carried by said outer housing for modulating the force exerted upon said inner expandable housing by said stored energy means, said modulating means comprising:

(i) a second expandable housing carried by said outer housing and operably associated with said first expandable housing, said second expandable housing comprising a bellows structure having an accordion-like side wall defining an air chamber for containing air, said second expandable housing having an outlet for permitting the flow of air there through and being movable from a substantially expanded configuration to a substantially collapsed configuration by force exerted thereon by said spring member; and

(ii) impedance means disposed within said outlet of said expandable housing for controllably impeding the flow of the air contained within said air chamber outwardly thereof.

(f) dispensing means carried by said outer housing for dispensing fluid to the patient;

(g) flow control means connected to said outer housing for controlling fluid flow between said reservoir and said dispensing means;

(h) volume indicator means carried by said outer housing for indicating the volume of fluid remaining in said fluid reservoir; and

(i) disabling means carried by said outer housing for preventing fluid flow toward said dispensing means.

23. The apparatus as defined in claim 22 in which said fill means comprises a first fill vial receivable within said third portion of said outer housing and in which said third portion of said outer housing includes:

(a) a fluid passageway;

(b) a first chamber for telescopically receiving said first fill vial;

and

(c) an elongated support mounted within said first chamber, said elongated support having an elongated hollow needle, said hollow needle defining a flow passageway in communication with said fluid passageway.

24. The apparatus as defined in claim 22 in which said outer housing includes a cavity in communication with said inlet of said fluid reservoir and in which said fill means comprises a pierceable septum disposed within said cavity.

25. The apparatus as defined in claim 22 in which said flow control means comprising a flow control assembly including:

(i) an ullage-defining member having a first portion disposed within said first expandable housing and a second portion having a fluid pas-

sageway in communication with said outlet of said fluid reservoir;

(ii) a flow control member rotatably mounted within said first portion of said ullage defining member, said flow control member having a plurality of elongated flow control channels, each of said plurality of elongated flow control channels having an inlet and an outlet; and

(iii) selector means rotatably connected to said second portion of said ullage defining member for rotating said flow control member to selectively align an outlet of one of said elongated flow control channels with said fluid passageway in said second portion of said ullage defining member.

26. The apparatus as defined in claim 25 in which said flow control assembly further comprises:

(a) an outer casing circumscribing said flow control member; and
(b) distribution means formed in said flow control member for distributing fluid from said fluid reservoir to each of said plurality of elongated flow control channels.

27. The apparatus as defined in claim 26, in which said flow control member is provided with an inlet passageway in communication with said fluid reservoir and in which said flow control assembly further includes filter means carried by said flow control member for filtering fluid flowing toward said distribu-

tion means.

28. The apparatus as defined in claim 27 in which said distribution means comprises a plurality of radially extending flow passageways formed in said flow control member.

29. The apparatus as defined in claim 28 in which said selector means comprises a selector knob connected to said flow control member, said selector knob having finger gripping means for imparting rotation to said selector knob to align said outlet of a selected one of said elongated flow control channels with said outlet of said fluid passageway in said second portion of said ullage defining member.